

# PATENT SPECIFICATION

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## (54) TEST APPARATUS

(71) We, SIMMS GROUP RESEARCH & DEVELOPMENT LIMITED, a British Company, of Concord Road, Western Way, Acton, London, W.3, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to test apparatus for use when testing the governor of a fuel injection pump, the latter having a fuel control rod which is moved by the governor as the speed at which the pump is driven is varied.

15 With a pump having a governor it is essential to test that the hysteresis of the governor over a particular speed range lies within prescribed limits and it is desirable that the test should be completed quickly. The hysteresis of the governor at a particular speed is represented by the difference between the position of the control rod at that speed when the speed is rising and the position of the control rod at that speed when the speed is falling.

20 The object of the invention is to provide such an apparatus in a simple and convenient form.

25 According to the invention apparatus for the purpose specified comprises means for providing a first voltage the magnitude of which varies with the speed at which the pump is driven, means for providing a second voltage indicative of the position of the control rod and a recorder to which said voltages are applied and which produces a display of the relative variation of said voltages as the speed at which the pump is driven is varied.

30 According to a further feature of the invention said first mentioned means provides signals at an upper and lower speed for control of the pump driving apparatus to effect a lowering or raising of the speed.

35 One example of an apparatus in accordance with the invention will now be described

with reference to the accompanying drawing.

As shown in the drawing there is provided a constant speed electric motor 10 which through the intermediary of an adjustable coupling 11 drives the fuel pump 12. The fuel pump is provided with a control rod 13 the axial position of which varies in accordance with the speed at which the pump is driven.

Also provided is a toothed rotor 14 and this is mounted upon the shaft which interconnects the coupling and the fuel pump or it may be mounted upon some other shaft which rotates at the same speed as the shaft or at some ratio of this speed.

Positioned adjacent the toothed rotor is a pick-up 15 which produces a series of pulses the frequency of which varies with the speed at which the rotor 14 is rotated. The output from the pick-up 15 is applied to a convertor 16 which produces a d.c. signal the magnitude of which varies in accordance with the speed at which the pump is driven. The d.c. signal is applied to an X-Y recorder indicated at 17. In the arrangement shown the d.c. voltage from the convertor 16 is applied to the X axis of the recorder after suitable amplification.

Connected to the control rod 13 is a linear transducer 18 which produces a d.c. output voltage the magnitude of which depends upon the axial position of the control rod 13. This voltage is applied to the Y axis of the recorder 17 again after suitable amplification.

In use, a test consists of the pump speed being increased from an initial low value to a high value followed immediately by a reversal so that the pump speed decreases to its low value again.

During these speed changes a hysteresis loop is drawn on a sheet of paper by the XY recorder. The vertical height of the traced loop at a particular value of X, representing the amount of hysteresis of the governor under test at the particular speed of the measurement.

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It is arranged that the convertor 16 produces signals at an upper and a lower speed, the difference between these two speeds being the speed range over which it is desired to check the governor. The two signals obtained from the convertor 16 are applied to the control mechanism of the coupling 11 so that when the speed at which the pump is driven attains the higher value, the coupling automatically adjusts itself to reduce the speed and vice versa if this should be necessary.

## WHAT WE CLAIM IS:—

1. A test apparatus for use when testing the governor of a fuel injection pump the pump including a fuel control rod movable by the governor, the apparatus comprising means for providing a voltage the magnitude of which varies with the speed at which the pump is driven, means for providing a second voltage indicative of the position of the control rod and a recorder to which said voltages are applied and which produces a display of the relative variation of said voltages as the speed at which the pump is driven is varied.
2. An apparatus as claimed in claim 1 in which said first mentioned means provides signals at an upper and lower speed for control of the pump driving apparatus to effect a lowering or raising of the speed.
3. An apparatus as claimed in claim 1 or claim 2 in which said voltages are d.c.

voltages.

4. An apparatus as claimed in any one of the preceding claims in which said means for providing said second voltage comprises a linear transducer operable by the fuel control rod.

5. An apparatus as claimed in any one of the preceding claims in which the means for providing the first voltage comprises a toothed rotor mounted on a drive shaft of the pump.

6. An apparatus as claimed in claim 5 including a convertor in which a.c. signals derived from the rotor are converted to a d.c. voltage to provide said first voltage.

7. An apparatus as claimed in claim 6 including an adjustable coupling through which the pump is driven.

8. An apparatus as claimed in claim 7 in which said convertor supplies said signals to effect raising and lowering of the speed at which the pump is driven.

9. A test apparatus for use when testing the governor of a fuel injection pump substantially as described with reference to the accompanying drawing.

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## COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of  
the Original on a reduced scale*